MAGNETIC FABRIC ORIENTATION IN IMPACT MELT BRECCIA AND TARGET ROCKS FROM THE DHALA STRUCTURE, NORTH-CENTRAL INDIA, USING AMS DATA. A. K. Singh[1], J. K. Pati[1,2], S. K. Patil[3], W. U. Reimold[4], A. K. Rao[1] and O. P. Pandey[1], [1]Department of Earth and Planetary Sciences, Nehru Science Centre, University of Allahabad, Allahabad-211002, India (anujpcb@gmail.com, jkpati@gmail.com), [2]National Centre of Experimental Mineralogy and Petrology, 14 Chatham Lines, University of Allahabad, Allahabad-211002, India, [3]Dr. K. S. Krishnan Geomagnetic Research Laboratory, Jhunsi, Allahabad-221505, India, [4]Laboratory of Geochronology, Instituto de Geociências, Universidade de Brasília, CEP70910 900 Brasília, DF, Brazil.

Introduction: The Dhala structure, north-central India (N 25º17'59.7" and E 78º8'3.1") occurs in an Archean, mixed crystalline basement. Dhala is one of the oldest (1.7-2.5 Ga) impact structures known to date on Earth. The estimated diameter, after erosion, is about 11 km. Impact melt breccia is exposed as curvilinear, discontinuous bodies over a strike length of nearly 6 km [1, 2, 3], and is characterized by the presence of diagnostic shock metamorphic features and containing a chondritic or iron meteorite impactor component [3]. Recently, a fragment of shatter cone has also been reported from an outcrop of monomict breccia, on an angular, medium-grained clast of granite [4]. The impact melt lithology is variously altered and at least two phases of hydrothermal alteration (~530 Ma and ~1 Ga) have been invoked from thermochronology [2, 3]. The disposition of impact melt as a curvilinear series of bodies on the geological map, and its substantial outcrop width (~170 m) suggest that either the impact melt occurs as a dike or a melt sheet. To resolve this issue the present study was carried out using anisotropic magnetic susceptibility (AMS) data for the impact melt rock. In addition, the effect of high kinetic energy on the magnetic fabric of the target granitoids was also investigated.

Material and Methods: In total, 19 impact melt breccia samples from 5 different outcrops and 12 target rock samples from 3 widely spaced locations (4 samples from each site) were chosen for anisotropic magnetic susceptibility analysis. Measurements were carried out using a Kappabridge apparatus (MFK1-FA) at the K.S. Krishnan Geomagnetic Research Laboratory (KSKGRL), Jhunsi, Allahabad, India.

Results: The low and high frequency magnetic susceptibilities were measured with the MS-2B instrument (LF: 68.08-211.56 x 10^{-8} m^3/kg^{-1}; HF: 62-190.70 x 10^{-8} m^3/kg^{-1}). The AMS fabric orientation of impact melt was measured at 5 locations, which determined the directions of maximum susceptibility (K_1: 1.005), intermediate susceptibility (K_2: 1), and minimum susceptibility (K_3: 0.994). The observed degree of anisotropy was 1.198 for the majority of the samples. In general, the distribution of AMS vectors is random in impact melt breccias, with few samples showing preferred orientation, whereas the magnetic fabrics are highly scattered in the target rocks. The impact melt is relatively more altered compared to the target rocks [2, 3] and yet the AMS fabric in the target rocks is random. This suggests a marginal effect of alteration on the AMS fabric. The AMS fabrics are represented by equal proportions of oblate and prolate shaped magnetic grains.

Importantly, the impact melt samples of the Dhala area do not show any preferred orientation. This suggests that the impact melt is more likely to occur as a melt body (sheet) rather than as a dike-like body. These inferences from the AMS fabric study are supported by the core drilling information obtained at about 70 locations, with coring depths down to 500 m. The drillings cover a major part of the Dhala structure. In fact, the melt body seems to spread over 12 sq km, for an estimated melt volume of about 2.4 km^3.

References: [1] Pati J. K. et al. (2008) *Meteoritics & Planet. Sci., 43,* 1383-1398. [2] Pati J. K. et al. (2010) *GSA Special Paper, 465,* 571-591. [3] Pati J. K. et al. (2017) *Meteoritics & Planet. Sci.,* 52, 722-736. [4] Pati J. K. et al. (2019) *Meteoritics & Planet. Sci.* (in press).